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NAT'L RESEARCH LABORATORY

CERES - CROP AND SOILS

NORTHERN REGIONAL RESEARCH LABORATORY

PUBLICATIONS AND PATENTS

January-June 1973

Agricultural Research Service
U.S. DEPARTMENT OF AGRICULTURE

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Northern Regional Research Laboratory
Agricultural Research Service
United States Department of Agriculture
1815 North University Street
Peoria, Illinois 61604

REQUEST FOR INFORMATION

Results of research investigations at the Northern Regional Research Laboratory are published regularly in the technical literature, and public-service patents are secured to cover patentable inventions and discoveries (see page 51). As a convenient guide to our publications and patents, a list with abstracts is published semiannually. These abstracts describe the current research and indicate the progress achieved. Further information on any of the developments, as well as earlier technical papers, may be obtained by writing us.

In conformance with the policy of the U.S. Department of Agriculture, Northern Laboratory publications are available to scientists and other specialists, librarians, representatives of the press, and others interested.

Reference to commercial equipment or proprietary products is made as part of the exact experimental conditions. Naming a company or product does not imply approval or

recommendation by the U.S. Department of Agriculture over others not mentioned.

Requests for specific reprints should be by number and addressed to the Northern Regional Research Laboratory. Those titles marked with an asterisk [*] are not available at the Northern Laboratory for distribution.

Most of the publications are in journals that are available in libraries. Photographic copies of most journal articles on research at this Laboratory can be purchased from the National Agricultural Library of the U.S. Department of Agriculture, Beltsville, Maryland 20705.

No publications will be sent regularly in response to foreign requests unless exchange arrangements have been made with the Director of the National Agricultural Library.

Copies of previous lists of publications and patents are available upon request.

January-June 1973

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JANUARY-JUNE 1973

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PUBLICATIONS

[Publications marked with an asterisk (*) are not available for distribution at the Northern Regional Research Laboratory. When requesting reprints, please order by number. Use your zip code.]

- 3250 • Aflatoxin. New Mold-Produced Poison Plagues Food and Feed
E. B. Lillehoj, Odette Shotwell, and C. W. Hesseltine
Crops & Soils 25(4): 12-14. January 1973

A broad assessment of natural aflatoxin occurrence is presented, and various techniques are described that have been employed to prevent formation of aflatoxin or to eliminate it in contaminated foods and feeds. Information is presented on the routine techniques that have been utilized to detect aflatoxin in commodities with description of the fluorescent method as a rapid presumptive test for determination of the development of the aflatoxin-producing molds *Aspergillus flavus* and *Aspergillus parasiticus*.

- 3251 • Cationic Epoxypropyl Starches and Flours As Wet-End
Paper Additives
R. E. Wing, W. M. Doane, and C. R. Russell
Tappi 56(1): 106-108. January 1973

Cationic starches and aminoethylated flours were reacted with various amounts of epichlorohydrin to yield cationic products with pendant epoxypropyl groups. These cationic derivatives were applied to hand-sheets as wet-end additives and significantly improved both wet- and dry-tensile properties over untreated controls.

- 3252 • Hydrogenation and Deuteration of Conjugated Isomers of Linoleate and Linolenate with Palladium, Platinum, Nickel, and Lindlar Catalysts
 Sambasivaraao Koritala, C. R. Scholfield, E. Selke,
 and H. J. Dutton
J. Amer. Oil Chem. Soc. 50(1): 11-15. January 1973

Conjugated isomers of methyl linoleate and linolenate were reduced with palladium, platinum, nickel, and Lindlar catalysts at atmospheric hydrogen or deuterium pressure. After the products were separated, positions of their double bonds were determined by ozonolysis.

Palladium and platinum catalysts reduced β -eleostearate directly to monoene. Nickel reduced β -eleostearate to dienes chiefly by 1,2-addition and to a lesser extent by 1,4- and 1,6-addition, whereas Lindlar catalyst reduced by 1,2- and 1,6-addition only.

All catalysts reduced conjugated linoleate isomers by both 1,2- and 1,4-addition, with nickel being somewhat preferential for 1,2-addition. Selectivity for the catalytic reduction of dienes to monoenes decreased in the order nickel, palladium, and platinum. Lindlar catalyst did not isomerize or reduce monoenes that formed during reduction. Palladium and platinum did not isomerize conjugated dienes and trienes during their reduction, whereas nickel and Lindlar catalysts isomerized them slightly.

Some deuterium was found in unreacted conjugated diene and triene with nickel and Lindlar catalysts but none with palladium or platinum. Deuterated products contained a wide range of isotopic isomers with some products having up to 31 deuterium atoms. This wide deuterium distribution resulted from (a) exchange followed by addition, (b) addition followed by exchange, and (c) exchange-addition-exchange reactions.

- 3253 • Superoxide Dismutase in *Bacillus popilliae*, a Catalaseless Aerobe
 Allan A. Yousten,¹ Lee A. Bulla, Jr., and Joe M. McCord²
 (¹Virginia Polytechnic Institute and State University,
 Blacksburg; ²Duke University Medical Center, Durham,
 North Carolina)
J. Bacteriol. 113(1): 524-525. January 1973

Bacillus popilliae, a cytochrome-containing aerobic organism that lacks catalase and peroxidase, was examined for superoxide dismutase activity. The activity was quite high relative to a wide variety of organisms previously surveyed, and was induced by oxygen. No correlation could be made between superoxide dismutase activity and the unexplained death of the organism after exponential growth was complete.

- 3254 • A V₇ Conformation of Dimethyl Sulfoxide-Amylose Complex
T. D. Simpson, F. R. Dintzis, and N. W. Taylor
Biopolymers 11(12): 2591-2600. December 1972

X-ray investigation of a crystalline complex between dimethyl sulfoxide (DMSO) and amylose indicates a sevenfold helical structure having an orthogonal unit cell: $a = 30.23 \text{ \AA}$, $b = 28.18 \text{ \AA}$, and $c = 7.91 \text{ \AA}$ (helix axis). This helical amylose results from precipitation of amylose in DMSO solutions under suitably dry conditions using toluene as a precipitating agent. Analyses show a molar ratio of 0.95:2:0.4:0.08 for DMSO, amylose glucose units, water, and toluene, respectively. DMSO and amylose combine in at least two crystalline conformations, sixfold and sevenfold helices. The amount of water present influences the resulting conformation. Existence of the sevenfold helical solid indicates that the amylose sevenfold helix has greater stability than previously recognized by conformational energy calculations. In general, potential energy calculations cannot be correct that ignore the influence of guest molecules and their effects upon the maltose residue conformation and that lead to a sixfold helix as the most probable structure.

- 3255 • Chemical Aspect of Jojoba Oil, A Unique Liquid Wax
from Desert Shrub *Simmondsia californica*
Thomas K. Miwa
Cosmet. Perfum. 88(1): 39-41. January 1973

Jojoba (*Simmondsia californica*) is the only plant known to produce seed that contains large quantities of liquid wax esters, which are monobasic esters of unsaturated long-chain fatty acids and fatty alcohols. Chemical aspects of jojoba oil are reviewed, and information is supplied on the composition of synthetic jojoba oil substitutes prepared at the Northern Regional Research Laboratory. Also included is a condensed review of a bulletin issued by an industrial corporation on the potential of jojoba oil as a therapeutic cosmetic.

- 3256 • Corn. Its Importance in Food, Feed, and Industrial Uses
F. R. Senti and W. C. Schaefer
Cereal Sci. Today 17(11): 352-356. November 1972

Corn (*Zea mays* Linnaeus) is usually considered to be indigenous to the Western Hemisphere, where it became the dominant food staple in the early civilizations of that part of the world. The first European settlers in the New World continued the propagation of corn. It became their major food staple and made a significant contribution to their successfull settlement. European explorers of the New World returned with corn to the Old World, where it spread rapidly throughout Europe, and from there to Asia and Africa. Thus, because of its large grain size, good yield, ease of cultivation, versatility, and storage character, corn was rapidly accepted in many parts of the world. This paper presents a review of U.S. and world utilization of corn for food, feed, and industrial purposes.

3257 • Continuous Production of Acrylonitrile-Starch Graft Copolymers by Ceric Ion Catalysis

Zoila Reyes,¹ Carroll F. Clark,¹ Frederick Dreier,¹

Russell C. Phillips,¹ C. R. Russell, and C. E. Rist

(¹Stanford Research Institute, Menlo Park, Calif.)

Ind. Eng. Chem. Process Des. Develop. 12(1): 62-67.

January 1973

The continuous production of graft copolymers of wheat starch with acrylonitrile (AN) was investigated in a semipilot-scale plant. Process variables were studied in runs of 10-20 pounds conducted with deoxygenated, aqueous AN-starch dispersions and an aqueous ceric ammonium nitrate solution. The reactants were fed simultaneously at controlled rates at the top of a stirred reactor column and, after a few minutes of retention in the column, the mixture was piped to a hold tank and periodically filtered. Large samples of AN-starch copolymers were prepared at different grafting levels, and their properties were evaluated. On the basis of the data developed, preliminary cost estimates were made on the process. Estimated selling prices range from 26 cents a pound (for a 9% graft) to 32 cents a pound (for a 52% graft).

3258* • Potential Mycotoxin Problems in Mould-Fermented Sausage

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Z. Lebensm. Unters.-Forsch. 150(3): 133-137. December 1972

A considerable proportion of the sausage consumed in many European countries is produced by a mold-fermentation process that does not involve pure culture techniques. A total of 442 *Penicillium* cultures isolated from mold-ripened sausages produced in 11 European countries were analyzed for their ability to produce the following nine mycotoxins: aflatoxin B₁ and G₁, ochratoxin A, penicillic acid, patulin, citrinin, tremortin A, zearalenone, rubratoxin B; 88 isolates were found capable of toxin synthesis (20.9%). Of these, 44 cultures produced penicillic acid, 17 ochratoxin A, 11 tremortin A, 10 citrinin, and 6 patulin. Three cultures produced both patulin and citrinin.

Sausages were ripened with 6 molds producing penicillic acid, 17 producing ochratoxin, 5 producing citrinin and 3 each producing patulin or tremortin. No mycotoxins were detected up to 70 days of ripening. Direct addition of penicillic acid to raw sausage resulted in disappearance of the mycotoxin. Amino acids normally occurring in meat were found capable of rapidly reacting with penicillic acid to produce adducts that were nontoxic to laboratory animals. Although our data indicate that consumption of mold-ripened sausage is not a health hazard with respect to the nine mycotoxins analyzed for, it is recommended that manufacturers of these products adopt pure culture techniques using molds known to be toxicologically safe.

- 3259* • Microbial Control of Insects: A Synopsis
Lee A. Bulla, Jr.
ASM News 39(2): 97-100. February 1973

A variety of microorganisms that includes bacteria, viruses, fungi, and protozoa are pathogenic to insects and have tremendous potential as insect control agents. Some of these microorganisms produce substances, separable from the individual cells, that are insecticidal. Discussed is the concept of regulating insect populations by such microbial agents.

- 3260 • Soybeans. Their Uses Are Many and Expanding All the Time
J. C. Cowan
Crops & Soils 25(5): 10-14. February 1973

The commercial processing and use of soybeans and soybean products in the United States are summarized. Processing oil and protein products, lecithin, texturized proteins, foreign and fermented foods, and future prospects are briefly reviewed.

- 3261 • Gas Chromatography-Mass Spectrometry of Methyl Esters
of Unsaturated Oxygenated Fatty Acids
R. Kleiman and G. F. Spencer
J. Amer. Oil Chem. Soc. 50(2): 31-38. February 1973

Silylation of hydroxyl groups in methyl esters of unsaturated hydroxy acids provides compounds that give mass spectra which can be readily interpreted, whereas spectra of underivatized esters are extremely difficult to evaluate. The relationship of the double bond(s) to the trimethylsiloxy (TMS) group causes specific mass spectral patterns. In esters that have the TMS group separated from the double bond by one methylene group, the ions caused by α -cleavage at the TMS group on the side closest to the olefinic group are much more abundant than those produced from α -cleavage on the other side of the TMS group. In esters that have the TMS group and the double bond separated by two methylene groups, α -cleavage ions are approximately equal. When the TMS group and the double bond are allylic, no fragmentation results between them. Cleavage does occur on either side of this system, and those ions resulting from cleavage alpha to the TMS group are in greatest abundance. Silylation of esters that have a conjugated diene or ene-yne system adjacent to a hydroxyl group also gives derivatives amenable to gas

chromatography-mass spectrometry. In these esters, large peaks are observed that arise from α -cleavage at the TMS group and at the other end of the olefinic system. No fragmentation between the TMS group and the sites of unsaturation occurs.

Unsaturated epoxy methyl esters produce spectra difficult to interpret. When the epoxide is converted to methoxy-hydroxy derivatives by BF_3 -methanol, the spectrum locates the position of the epoxide group. Silylation of the hydroxy group produces a compound that gives a less complicated spectrum which also locates the original epoxy group.

Mass spectrometry of a series of unsaturated keto-esters, without derivatization, provides spectra that are easily interpretable.

- 3262 • Catalytic Carboxylation of Fats. Carboxy Acids and Esters from Monounsaturates
E. N. Frankel and F. L. Thomas
J. Amer. Oil Chem. Soc. 50(2): 39-43. February 1973

A highly selective catalytic, one-step synthesis converts oleic acid into 9(10)-carboxystearic acid in high yields (85-99%). Hydrocarboxylation with water and carbon monoxide under pressure (3,000-4,000 p.s.i.) is catalyzed with a mixture of palladium chloride and triphenylphosphine at 120-150° C. with or without acetone or acetic acid solvents. Palladium supported on carbon is also an effective hydrocarboxylation catalyst in the presence of triphenylphosphine and HCl. Methyl 9(10)-carbomethoxy-stearate was prepared by catalytic carbomethylation of methyl oleate with methanol and carbon monoxide but in lower yields. The carboxystearic acids and esters consisted of the 9 and 10 isomers (87-94%) in approximately equal proportions. This catalytic carboxylation procedure is a more efficient route to carboxystearic acid and ester than the two-step hydroformylation-oxidation process reported previously. Carboxylated acids, methyl esters, and triglycerides of potential industrial importance have been prepared.

- 3263 • Glutenin--The Strength Protein of Wheat Flour
J. A. Bietz, F. R. Huebner, and J. S. Wall
Baker's Dig. 47(1): 26-31, 34-35, 67. February 1973

Glutenin is the wheat flour protein most responsible in giving strength and elasticity to dough. Studies involving new techniques have now begun to explain glutenin's properties on the basis of its structure. Glutenin consists of many high-molecular-weight loosely organized proteins formed by inter-chain disulfide bonding of subunits. We have now separated some

of these subunits and characterized them as to amino acid composition and molecular weight. There are two or three distinct types of glutenin subunits, which are probably synthesized in different organelles within the endosperm and which join together during maturation. The presence or amount of some of these subunits differs between varieties, and may influence wheat quality. High-molecular-weight glutenin molecules result in long mixing times and high dough stability, but in dough the glutenin must interact with suitable levels of gliadin and other proteins to achieve optimum flour performance and loaf volume in modern breadmaking processes.

3264 • Microbial Survey of Corn in 1970-1971

R. J. Bothast, R. F. Rogers, and C. W. Hesseltine
Cereal Sci. Today 18(1): 22-24. January 1973

The microbiology of whole corn, brewers' grits, and break flour from three midwestern mills was studied. Arrangements for the samples needed in this survey were made with the American Corn Millers Federation. Duplicate samples were taken 1 week apart from each cooperating mill in November, February, May, and August. Microbiological analyses included counts of total aerobic bacteria, molds, and Actinomycetes. The distribution and kind of fungi infecting whole corn were determined. Respective counts for bacteria, molds, and Actinomycetes ranged from 10^2 to 10^6 , 10^2 to 10^6 , and 0 to 10^3 per gram of sample. Statistical analysis showed a significant interaction between mill and fraction for bacteria and molds. Samples from Mill 2 had higher counts than those from Mills 1 and 3. Counts from Mill 3 varied less. Generally, grits were lowest in microbial counts, followed by whole corn, and then flour. Although *Penicillium* and *Fusarium* species predominated among the molds, the numbers of *Aspergillus*, *Helminthosporium*, *Nigrospora*, and *Trichoderma* species were significant. Apparently, the southern corn blight did not change the normal microflora of corn.

3265 • Practical Synthesis of Methyl 4-O-Methyl- and Methyl 4-O-Benzyl- α -D-glucopyranoside

J. W. Van Cleve and C. R. Russell
Carbohydr. Res. 25(2): 465-473. December 1972

Gram amounts of pure, crystalline methyl 4-O-methyl- and methyl 4-O-benzyl- α -D-glucopyranoside have been prepared from methyl 4,6-O-benzylidene- α -D-glucopyranoside in 40% overall yields by a method that appears to constitute a practical synthesis of methyl 4-O-alkyl- α -D-glucopyranosides.

3266* • Synthesis of Graft and Block Copolymers of Starch

George F. Fanta

In "Block and Graft Copolymerization," ed. R. J. Ceresa, vol. 1, chap. 1, pp. 1-27. New York. 1973

This review describes the synthesis of graft and block copolymers of starch and acrylonitrile, acrylamide, acrylic acid, and monomers with amino substituents--methyl methacrylate, acrylic acid esters, vinyl acetate, styrene, butadiene, vinyl chloride, and *N*-vinyl-2-pyrrolidone. Free radical graft polymerization can be initiated as easily as anionic graft polymerization with chemical initiators and also with cobalt 60 or electron beam irradiation. Reaction conditions influence the structure of the graft copolymer; i.e., the percentage of synthetic polymer incorporated in the graft copolymer, the molecular weight of grafted branches, and the grafting frequency.

3267* • Properties and Applications of Graft and Block Copolymers of Starch

George F. Fanta

In "Block and Graft Copolymerization," ed. R. J. Ceresa, vol. 1, chap. 2, pp. 29-45. New York. 1973

Some of the properties of starch graft copolymers discussed in this review are: physical appearance; solubility or dispersibility in different solvent systems; thermoplasticity; and molding properties. Potential uses of starch graft copolymers, for example, as thickening agents, paper additives, flocculants, and additives for flotation processes, are also considered.

3268 • Hydrolysis Products of 4-Acetamido-4-hydroxy-2-butenoic Acid γ -Lactone

Michael D. Grove and David Weisleder

J. Org. Chem. 38(4): 815-816. February 1973

4-Acetamido-4-hydroxy-2-butenoic acid γ -lactone (1a) is a mycotoxin produced by *Fusarium tricinctum*. Hydrolysis studies of 1a have shown that under acidic conditions the major 4-carbon product is malealdehydic acid (1b), whereas in alkali fumaraldehydic acid (2) predominates. Nuclear magnetic resonance data confirm the existence of 1b in the cyclic pseudo-acid form. A comparison sample of 1b was prepared by photosensitized oxygenation of furfural in H₂O-EtOH. Compound 2 was obtained by bicarbonate isomerization of 1b.

3269 • Hydroformylation of Methyl Linoleate and Linolenate with Rhodium-Triphenylphosphine Catalyst

Edwin N. Frankel, Freddie L. Thomas, and William K. Rohwedder
Ind. Eng. Chem. Prod. Res. Develop. 12(1): 47-53. March 1973

Hydroformylation of methyl linoleate and linolenate with a rhodium-triphenylphosphine catalyst yields 1,4-diformyl esters as main products and 1,3-diformyl esters as minor products. Unsaturated and saturated monoformyl esters are also produced from both substrates and triformal esters from methyl linolenate. Conjugated methyl linoleate produces mainly monoformyl esters, whereas methyl *cis*-9, *cis*-15-octadecadienoate produces diformyl esters. The mechanism postulated for dihydroformylation involves cyclic unsaturated acyl-rhodium-triphenylphosphine complexes controlling the position of the second formyl group. These intermediates are also implicated in double bond hydrogenation and isomerization which accompany dihydroformylation. The polyformyl ester products formed contrast with the monoformyl ester products obtained when cobalt carbonyl catalysts are used.

3270 • Ammonia Kills Spoilage Molds in Corn

R. J. Bothast, E. B. Lancaster, and C. W. Hesseltine
J. Dairy Sci. 56(2): 241-245. February 1973

Corn containing 26% and 12% moisture were treated with ammonia at 2% and 0.5% of corn dry weight, respectively. Ammoniation at both concentrations eliminated external and infecting molds and yeasts and tended to reduce bacterial counts. Molds killed were species of *Aspergillus*, *Penicillium*, *Fusarium*, *Trichoderma*, and *Rhizopus*. In feeding trials, mice showed no preference between tempered and 2% ammoniated corn that initially had a pungent odor, but mice consumed more control corn than corn ammoniated at 0.5%.

3271 • A Search for New Fiber Crops. Potential of Sorghums for Pulp and Paper

T. F. Clark, G. H. Nelson, R. L. Cunningham, W. F. Kwolek,¹ and I. A. Wolff²

(¹Biometrical Services, North Central Region, Peoria, Ill.;

²East. Reg. Res. Lab., Philadelphia, Pa.)

Tappi 56(3): 107-110. March 1973

More than 125 accessions representing five species of sorghums (*Sorghum alnum*, *Sorghum bicolor*, *Sorghum durra*, *Sorghum halepense*, and *Sorghum sudanense*) were evaluated on the basis of physical and chemical composition as fibrous raw materials for pulp and papermaking. Considerable variation in properties occurred according to year, species, and line.

Among promising samples crude cellulose values ranged from 42.6% to 55.9%; alpha cellulose contents, 26.0% to 36.3%; and arithmetic average fiber lengths, 0.80 to 1.77 mm. All accessions of *S. alnum* contained less than 14% pith. Many samples of *S. bicolor* had less than 20% pith. While all species and botanically recognized intraspecies types examined except *S. bicolor* var. *drummondii* appeared promising, seven lines particularly merit further consideration for papermaking. These include PI 202410, PI 207836, and PI 207840 among *S. alnum*, and PI 229837, PI 177549, PI 71309, and CI 792 from *S. bicolor*.

- 3272 • Separation of Erythrose and Glyoxal by Countercurrent Liquid-Liquid Extraction
 C. S. Wise and C. L. Mehltretter
Staerke 25(2): 51-56. February 1973

A countercurrent liquid-liquid extraction procedure is described for the separation of erythrose and glyoxal obtained by sulfurous acid hydrolysis of dialdehyde starch.

- 3273 • Control of Pantothenate Accumulation in *Agrobacterium tumefaciens*
 Tsuneo Kaneshiro, Larry O. Arthur, and Kenneth W. Nickerson
J. Bacteriol. 113(2): 619-626. February 1973

Two pantothenate-requiring mutants of *Agrobacterium tumefaciens* have been isolated. One of them (strain WMP-1) is unusual in that growth levels equivalent to the parent strain are achieved only when the medium is additionally supplemented with aspartate or another compound related to the tricarboxylic acid cycle. Extracts of cells grown on limiting aspartate were found to contain four times more ^{14}C -pantothenate than those grown at optimal aspartate concentrations. This difference was found in both the perchloric acid-soluble and -insoluble fractions, presumably the coenzyme A pool and acyl carrier protein, respectively. These findings are discussed in terms of membrane integrity and the control of fatty acid biosynthesis.

- 3274 • Fatty Acid Esters of Alkoxylated Glycosides of Glycerol and Propylene Glycol as Food Emulsifiers
 C. A. Wilham, T. A. McGuire, C. L. Mehltretter,
 and Helen H. Palmer¹
 (¹West. Reg. Res. Lab., Albany, Calif.)
Food Prod. Develop. 7(1): 59-60. February 1973

A series of fatty acid esters of alkoxylated glycosides of glycerol and propylene glycol was evaluated as emulsifiers in a simple French dressing.

- 3275* • Pathogene und Toxinogene Hefen und Schimmelpilze in Fleisch und Fleischwaren [In German. Pathogenic and Toxinogenic Yeasts and Mould Fungus in Meat and Meat Products]

H.-J. Mintzlaff,¹ A. Ciegler, and L. Leistner¹

(¹Bundesanstalt für Fleischforschung, Kulmbach, West Germany)

Arch. Lebensmittelhyg. 23(12): 286-291. December 1972

Yeast potentially pathogenic to man and molds capable of mycotoxin synthesis were isolated from microbially cured meats and meat products. It is recommended that the meat industry adopt pure culture techniques in producing these products. Culture suggestions are given.

- 3276 • Extraction of Soybean Meal Proteins with Salt Solutions at pH 4.5

Robert L. Anderson, Walter J. Wolf, and Donald Glover¹

(¹Bradley University, Peoria, Ill.)

J. Agr. Food Chem. 21(2): 251-254. March-April 1973

Extractable Kjeldahl nitrogen increased with increases in concentration of sodium or calcium chloride until a maximum of 65% of the nitrogen in the flakes was extracted. This maximum occurred with 0.3 N calcium chloride or 0.7 N sodium chloride. Without added salts, the pH 4.5 extract contained only 2S and 7S ultracentrifuge components. Up to 0.3 N sodium chloride 2S protein increased, whereas the 7S component did not reach a maximum until 0.7-0.8 N salt. The 11S component began to dissolve at 0.3 N salt and was completely solubilized at 0.8 N. The 15S component did not dissolve until concentrations of salt were greater than 0.4 N and increased in extractability up to 0.8 N sodium chloride. Calcium chloride extracts contained increasing amounts of 2S and 7S fractions up to 0.2 and 0.3 N, respectively. The 11S component began to dissolve at 0.1 N and increased in solubility up to 0.4 N calcium chloride. The 15S material did not dissolve significantly below 0.2 N and increased in extractability up to 0.4 N calcium chloride.

- 3277 • The Pattern of Sporulation of *Bacillus popilliae* in Colonies

E. S. Sharpe and R. A. Rhodes

J. Invertebr. Pathol. 21(1): 9-15. January 1973

Spores accumulate periodically in colonies of *Bacillus popilliae* after 3 days of vegetative growth on solid medium. Sporulation occurs on the surface and primarily in a ring near the periphery, causing slight changes in colony contour. The formation of mature spores and their acquisition of resistance to drying and to heat occur in a stepwise manner. A high level of prespore forms persists in mature colonies. Sporulation in colonies is as efficient as early stages of sporulation in larvae, but efficiency in vivo must increase as milky disease progresses.

- 3278 • Oxygenation of Unsaturated Fatty Acids in Seeds During Storage
 G. F. Spencer, F. R. Earle, I. A. Wolff,¹ and W. H. Tallent
 (¹East. Reg. Res. Lab., Philadelphia, Pa.)
Chem. Phys. Lipids 10(2): 191-202. February 1973

Seeds of *Cichorium intybus* L., *Crepis thomsonii* Babc., and *Crepis vesicaria* L. were stored from 4 to 8 years at 5° C. and then for 18 months under a variety of conditions. Oxygenated acids in *Cichorium intybus* oil increased from approximately 1% initially to 3% in the first storage period and to 17% while stored at room temperature during the second period. The corresponding levels at these three stages for *Crepis thomsonii* were 2, 6, and 18%. By gas chromatography (GC) and GC-mass spectrometry, the major oxygenated acids formed during storage were identified as hydroxy acids with conjugated unsaturation and 9,10-epoxy acids. In *Crepis vesicaria* seed, oil of which contained 53% vernolic (12,13-epoxy-9-octadecenoic) acid originally, approximately 2% of 9,10-epoxides were formed during the storage at room temperature. Levels of hydroxy acids with conjugated unsaturation in this species were 0.3% initially, 2% after 5 years at 5° C., and 9% after 18 months at room temperature. Primary substrates from which oxygenated acids were formed in the three species were crepenynic and linoleic acids, and the almost exclusive formation of 9,10-epoxide from linoleic indicated enzymatic involvement.

- 3279 • New Biodegradable Surfactants Derived from Starch:
 Preparation and Properties
 P. E. Throckmorton,¹ David Aelony,¹ R. R. Egan,¹ and F. H. Otey
 (¹Ashland Oil Inc., Columbus, Ohio)
Tenside Deterg. 10(1): 1-7. January-February 1973

Starch-derived glycol and glycerol glycosides produced surfactants of industrial quality when combined with 10 to 15 moles of alkoxides (ethylene oxide or a mixture of ethylene and propylene oxide) and with 1 to 2 moles of C₁₀ to C₁₄ α-olefin oxides. Furthermore, these new surfactants were highly biodegradable. Sulfates and fatty ester derivatives of the glycosides performed poorer than those based on fatty ethers.

- 3280 • Growth of *Hansenula holstii* on Cadavers
 C. P. Kurtzman, J. C. Gentles,¹ E. G. V. Evans,² M. E. Slodki,
 and R. M. Ward
 (¹University of Glasgow, Glasgow, Scotland; ²The General
 Infirmary, Leeds, England)
Appl. Microbiol. 25(2): 184-186. February 1973

Growth of a yeast was observed on prospected cadavers used for demonstration purposes in a medical school. An asporogenous yeast was isolated and identified as an atypical form of *Hansenula holstii* by analysis of the extracellular polysaccharide. The isolate showed resistance to embalming fluid but was eventually eradicated by addition of picloxidine digluconate to the fluid.

3281 • Soybean Polyamines. Separation and Characterization
of Cadaverine

L. C. Wang and E. Selke

Plant Physiol. 51(3): 432-435. March 1973

Cadaverine in soybeans was separated by ion exchange chromatography from other polyamines previously identified. Identification of cadaverine was based on ion exchange separation, thin layer chromatography, paper electrophoresis, mass and nuclear magnetic resonance spectral analyses. Since the molecules of putrescine and cadaverine are so similar, separation and identification of the two components are difficult. Their R_F values on thin layer chromatography are close, although cadaverine produces a bluish purple color when sprayed with ninhydrin reagent, while putrescine forms a purple color. Separation likewise is poor by paper electrophoresis, gas chromatography, and gel filtration. The mass spectra of cadaverine and putrescine have m/e peaks at 30, 43, 45, 56, 73, 85, 102 and 30, 43, 59, 71, 88, respectively. The m/e peaks differentiate one compound from the other. Nuclear magnetic resonance spectra and their integration curves show that cadaverine contains two types of methylene protons (10 total) in 3:2 ratio while putrescine produces two types (8 total) in 1:1 ratio. Polyamines occur at levels of micrograms per gram of soybeans with spermidine present in the largest quantity.

3282 • Acid-Modified Wheat Flours. Contributions of Starch and Protein Components to Paste Properties and Performance of the Flours as Surface Sizes for Paper

J. C. Rankin, J. H. Samalik, C. R. Russell, and C. E. Rist
Cereal Sci. Today 18(3): 74-76, 81. March 1973

Acid-modified soft wheat flour (AMF-321) and its hydroxyethylated derivative (HEAMF-223), designed for surface sizing paper, were separated into their major components of starch and protein. Physical properties of the starch and protein fractions were characterized, and their relative contribution to paste and sizing properties of the parent modified flours was determined.

Protein was separated by extracting the modified flour with dilute acetic acid. The starch fraction from both flour products contained about 2% protein, which could not be removed by ordinary means. Intrinsic viscosities of starch fractions were essentially the same as that of a commercial reference starch but somewhat higher than those of their modified flours. Intrinsic viscosities of protein fractions were 0.32 for HEAMF-223 and 0.31 for AMF-321 as compared to 0.30 for the protein from the unmodified flour. Electrophoretic analyses of protein fractions showed that acid modification decreased the α -component and increased

β -, γ -, and ω -components. The additional treatment of hydroxyethylation restored the loss in the α -component and made the β - and γ -components inseparable.

Modified flours and their starch fractions were comparable to the commercial starch in paste properties and in paper handsheet tub-sizing trials. Apparently, the removable protein had little effect on paste and sizing properties of the modified flour.

- 3283 • Publications and Patents of the Northern Regional Research Laboratory, July-December 1972
U.S. Agr. Res. Serv., Unnumb. Pub., 56 pp. [February 1973]

- 3284* Untersuchungen über das Toxinbildungsvermögen von Rohwürsten isolierter Schimmelpilze der Gattung *Penicillium* [In German, with English and French abstracts. Investigations into the toxin-forming ability of moulds of the genus *Penicillium* isolated from dry sausages]
A. Ciegler, H.-J. Mintzlaff,¹ Waltraud Machnik,¹ and L. Leistner¹
(¹Bundesanstalt für Fleischforschung, Kulmbach, West Germany)
Fleischwirtschaft 52(10): 1311-1314, 1317-1318. October 1972

Mycotoxins are substances which are formed by certain molds and which are toxic and under some circumstances carcinogenic. These metabolic products which have been detected in food and feed can cause poisoning in man and in animals. A total of 422 *Penicillium* which had been isolated from 44 mold-ripened dry sausages originating in 11 different countries were examined for their ability to form toxins. The mycotoxins considered were aflatoxin B₁ and G₁, citrinin, ochratoxin A, patulin, penicillic acid, rubratoxin B, tremortin A, and cearalenon. Toxin formation was observed in 88 strains, i.e. 20.9%, and of these 44 strains synthesized penicillic acid, 17 ochratoxin A, 11 tremortin A, 10 citrinin, and 6 patulin. It was observed for the first time that penicillia are able to form the mycotoxins patulin and citrinin simultaneously: this was noted in three strains. Of the 422 molds examined, 146 strains were identified and could be assigned to 18 species. The toxinogenic *Penicillium* strains represented 13 identified species. In 26 and 13 strains *P. viridicatum* and *P. expansum* respectively were the toxinogenic penicillia most often represented. Synthesis of the mycotoxins penicillic acid, ochratoxin A, tremortin A, citrinin, or patulin could be detected in 53% of the isolates of these two mold types. It was observed that the mold types shown below form the following mycotoxins: penicillic acid: *P. viridicatum*, *P. expansum*,

P. janthinellum, *P. cyclopium*, *P. simplicissimum*, *P. commune*, and *P. martensii*; ochratoxin A: *P. viridicatum*, *P. variabile*, *P. commune*, *P. cyclopium*, and *P. purpureescens*; tremortin A: *P. palitans*, *P. commune*, and *P. frequentans*; citrinin: *P. citrinum*, *P. claviforme*, and *P. expansum*; patulin: *P. expansum*. To test the ability of the molds named to form toxins on a meat substrate, dry sausages were inoculated immediately after filling with various mold strains which formed penicillic acid, ochratoxin A, citrinin, patulin, and tremortin A on synthetic media. During ripening the sausages were examined at certain intervals but the toxins named could not be detected in the dry sausage. When the mycotoxin penicillic acid was added directly to the dry sausage filling, it could no longer be detected after a short time. Various amino acids (cystein, glutathione, lysine, arginine, and histidine) which are normally present in meat evidently react very quickly with penicillic acid, addition-compounds being formed which are not toxic to laboratory animals apart from the chicken embryo. The chemical structure of the addition-compounds between penicillic acid and cystein or glutathione was explained. Although our experimental results indicate that mold-ripened dry sausages are no danger to the health of the consumer, at least not as regards the nine mycotoxins examined, we ought nevertheless to use only toxicologically tested and technologically suitable mold strains in pure cultures for dry sausage manufacture. This will also accelerate the manufacturing processes for mold-ripened dry sausage and improve the quality of the products.

- 3285 • *Saccharomyopsis crataegensis*, A New Heterothallic Yeast
C. P. Kurtzman and L. J. Wickerham
Antonie van Leeuwenhoek J. Microbiol. Serol. 39(1): 81-87. 1973

A new species, *Saccharomyopsis crataegensis*, is described. The species is heterothallic and forms ellipsoidal ascospores with a single median longitudinal ledge. Strains of the species were isolated from grapes and hawthorne berries collected in Peoria, Illinois, U.S.A. Species of *S. crataegensis* and *S. vini* were compared, including new strains of *S. vini* from hawthorne fruit.

- 3286 • Interpolymer from Starch Xanthate and Polyamide-Polyamine-Epichlorohydrin Resin: Structure and Papermaking Application
M. E. Carr, W. M. Doane, G. E. Hamerstrand, and B. T. Hofreiter
J. Appl. Polym. Sci. 17(3): 721-735. March 1973

The efficacy of oxidatively crosslinked starch xanthate for improving wet- and dry-strength properties of paper prompted the present study of an alternative, interpolymeric crosslinking procedure. Sodium starch xanthate of degrees of substitution 0.05-0.25 was reacted with a commercial paper additive (a polyamide-polyamine-epichlorohydrin wet-strength resin) which was found to contain 3-hydroxyazetidinium chloride, epoxy-propyl, and chlorohydrin groups (3:1:1) to give an interpolymer crosslinked by both ionic and covalent bonds. Model systems, in conjunction with nuclear magnetic resonance, infrared, and ultraviolet spectral data, served to elucidate reaction mechanisms and structures of the interpolymer and the commercial resin. Reaction conditions that favored formation of either ionic (polysalt) or covalent (xanthate ester) crosslinks were investigated. In preliminary evaluations, incorporation of the interpolymer into paper handsheets resulted in excellent wet- and dry-strength improvements.

- 3287 • Catalytic Autoxidation of 9(10)-Formylstearic Acid
A. W. Schwab
J. Amer. Oil Chem. Soc. 50(3): 74-75. March 1973

A procedure has been developed to prepare carboxystearic acid by catalytic autoxidation of hydroformylated oleic acid. This autoxidation is catalyzed effectively with Ca, Cu, Co, Fe, Mn, and Ce naphthenates in either acetone or glacial acetic acid at 20° C. With the exception of Ca, all these catalysts produce from 2 to 10% keto- and hydroxystearic acids as by-products. Yields of up to 95% 9(10)-carboxystearic acid are obtained by autoxidation for 24 hours with Ca naphthenate as catalyst. This autoxidation period was shortened to 7 hours by using a binary mixture of 0.5% Ca and 0.05% Mn, which affords a minimum of side products.

- 3288 • New Corn Protein Isolate--Nutritive, Functional
H. C. Nielsen, G. E. Inglett, J. S. Wall, and G. L. Donaldson
Food Eng. 45(4): 76-78. April 1973

USDA-developed isolate has some 73% protein and good amino-acid balance. Soluble at neutral and low pH, it also stabilizes oil-in-water emulsions. It would cost more than soy isolate, but less than sodium caseinate. In continuing application research on defatted corn-germ flour, additional data has been compiled on cooking and baking characteristics and taste panel evaluations. A defatted flour prepared from a commercial dry-milled fraction was added to cookies, muffins, and ground beef. The flour contained about 25% protein, 0.5% fat, 4% fiber, and 10% ash.

- 3289 • Hydrolyzed Starch-Polyacrylonitrile Graft Copolymers
[G. F. Fanta, M. O. Weaver, and E. B. Bagley]
North. Reg. Res. Lab.
U.S. Agr. Res. Serv., CA-NRRL-38, 3 pp. April 1973 [Processed]

A new graft copolymer, developed at the Northern Regional Research Laboratory, has a backbone of starch with grafted branches which are made up of acrylamide and acrylic acid repeating units. A wide variety of compositions are possible, since the molecular weight of starch, the molecular weight of the grafts, the ratio of acrylamide to acrylic acid, and the frequency of grafting may be varied.

- 3290 • Tritium Labeling of Lipids
T. L. Mounts
Lipids 8(4): 190-193. April 1973

The elucidation of metabolic pathways, chemical reactions, and biosyntheses has been greatly enhanced by the use of radioisotopes. Tritium has become an important tool in lipid research. Lipids have been labeled with tritium by a variety of techniques, including chemical synthesis, catalytic reductions, exchange reactions, and radiation-induced reactions. Specific examples of labeling procedures are presented. Recent developments in tritium analysis instrumentation and procedures are also presented. Current applications of tritium as a tracer are in biological investigations and catalytic hydrogenation of lipids.

- 3291 • Linseed Oil. Curing-Antiscaling Emulsion for Concrete
[W. L. Kubie]
North. Reg. Res. Lab.
U.S. Agr. Res. Serv., CA-NRRL-39, 7 pp. April 1973 [Processed]

For several years the Northern Regional Research Laboratory has conducted research on the use of linseed oil for coating concrete. This research includes studies both on curing concrete and on protecting concrete against scaling and spalling caused by freezing and thawing. Substantial savings can be realized by applying an NRRL boiled linseed oil emulsion as a curing compound shortly after placing concrete, and the antiscaling effect of this emulsion lasts for at least 2 years. This procedure eliminates cleaning, drying, and traffic control required when antiscaling agents are applied 14 to 30 days after curing. After 2 years the pavement should be treated periodically with linseed oil. Such treatment may already be standard practice for pavement in some locations. Standard practice is to use the most economical form of linseed oil as an antiscaling agent. To date, linseed oil dissolved in a mineral spirits solvent has served this purpose.

3292 • Kinetics of the Xanthan Fermentation

R. A. Moraine and P. Rogovin

Biotechnol. Bioeng. 15(2): 225-237. March 1973

Xanthan gum, a heteropolysaccharide with unusual and useful properties, is now produced commercially by fermentation with *Xanthomonas campestris* NRRL B-1459 in a medium containing glucose, minerals, and a complex nitrogen source--distillers' dried solubles (DDS). Understanding the kinetics of the fermentation should contribute to process improvements and increase the market potential for the gum. Earlier studies showed that although DDS determined initial growth rate, growth was stopped by some mechanism other than substrate exhaustion, probably an effect related to product formation.

Product formation did not require active growth, but its rate increased with cell concentration. Specific product formation rate declined at high viscosities. Varying glucose concentration from 0.5 to 5.0% and dissolved O₂ tension between 20 and 90% air saturated had no effect on the rates, but pH had to be maintained near 7 and temperature near 28° C. to permit continued product formation. Xanthan yield could be explained by the energy required for growth and polymerization, that energy coming from dissimilation of the part of the carbohydrate substrate not converted to polymer.

3293 • Conjugation of Polyunsaturated Fats with Dimsylsodium

W. J. DeJarlais, L. E. Gast, and J. C. Cowan

J. Amer. Oil Chem. Soc. 50(4): 108-109. April 1973

The conjugation of polyunsaturated fatty esters, including soybean oil, trilinolein, soybean methyl esters, and methyl linolenate and linoleate, with the sodium salt of dimethyl sulfoxide (dimsylsodium) as catalyst has been investigated. Methyl esters are about 95% conjugated within 2 hours. Glycerides react more slowly but are similarly conjugated within 24 hours. The glyceride linkages are not destroyed as they would be with aqueous or alcoholic alkali. Highly conjugated oils can thus be prepared.

3294 • Hydrogenation of Alkali-Conjugated Linoleate: Isomeric Monoene Profiles Obtained with Nickel, Palladium and Platinum Catalysts

Sambasivarao Koritala

J. Amer. Oil Chem. Soc. 50(4): 110-111. April 1973

Alkali-conjugated linoleate (*cis*-9, *trans*-11- and *trans*-10, *cis*-12-octadecadienoate) was hydrogenated with nickel, palladium, and platinum catalysts. The *trans* and *cis* monoenes formed during reduction were isolated, and their double bond distribution was determined by reductive ozonolysis and gas

liquid chromatography. About 44-69% of the monoenes were composed of Δ^{10} and Δ^{11} *trans* monoene isomers, whereas the Δ^9 and Δ^{12} *cis* monoenes amounted to 20-26%. With nickel catalyst, composition of monoene isomers remained the same, even when the hydrogenation temperature was increased. The monoene isomer profiles between nickel and palladium catalysts were indistinguishable. Isomerization of monoenes with platinum catalyst was suppressed at 80 p.s.i. The position of the double bonds in unreacted conjugated diene was always retained, except with nickel at both temperatures and with platinum at 150° C. when a slight migration occurred. Geometrical isomerization to *trans, trans*-conjugated diene was observed in the unreacted diene with nickel (about 15% of diene) at both 100° C. and 195° C., and with platinum (about 7% of diene) at 150° C.

3295 • Protein-Fortified Extruded Food Products

H. F. Conway and R. A. Anderson

Cereal Sci. Today 18(4): 94-97. April 1973

Mixtures of yellow-corn snack grits with four high-protein products, and of five other starchy materials with soy flakes were processed in a high-temperature short-time extruder. These extruded products are completely cooked and have potential as a base for gruel or soups; as a beverage, especially if sweetened and flavored; and after coating with oil and adding seasoning, as a high-protein snack item.

3296 • Ultraviolet Spectral Determination of Lignin

M. O. Bagby, R. L. Cunningham, and R. L. Maloney

Tappi 56(4): 162-163. April 1973

Lignin in fibrous products derived from kenaf (*Hibiscus cannabinus* L.) was determined by a modified ultraviolet (UV)-acetyl bromide method. The precision of the UV method applied to a benzene:alcohol-extracted green kenaf was 2.2% relative standard deviation. The difference in lignin content determined for green kenaf with and without preextraction by a benzene:alcohol azeotrope was not significant. Comparison of all UV lignin determinations with those from an 80% sulfuric acid procedure shows a correlation coefficient of 0.97, but a significant difference (95% confidence level) exists between methods for the determination of residual lignin in pulps. To facilitate interlaboratory comparison of data, the spectral determination of lignin in kenaf has been related to the absorptivity of vanillin. The potential advantages offered by reduced sample requirements and increased precision, as well as facility and speed, make the spectral determination of lignin an attractive method.

3297* • Some New Derivatives of Linseed Oil of Potential Commercial Interest

J. C. Cowan

Proc. 42nd Annu. Flax Inst. of the U.S., Fargo, N. Dak.,
pp. 5-7. November 16, 1972

Continued research is needed to find new outlets for linseed oil, which is one of the major products from flax and which continues to receive competition from petroleum-derived products. Recently, we started investigations on procedures to convert the double bonds of linseed oil to different and more reactive groups. The new groups permit preparation of new polymeric products of potential commercial interest.

For the partially epoxidized linseed oil derived products, acceptable procedures are now available to make new films with commercially available products. The studies on the oxo reaction are more long term because we do not yet have an economic process to make the derivatives from linseed oil. Work is underway to find such a process for the linseed polyderivatives. The importance of our work on linseed polyalcohol resides in the solventless approach to coating of surfaces.

3298 • Formation of Hyphae and Chlamydospores by *Cryptococcus laurentii*
C. P. Kurtzman
Mycologia 65(2): 388-395. March-April 1973

Mixtures of strains of *Cryptococcus laurentii* isolated from wheat and corn formed conjugation tubes after 7-10 days at 15° C. on malt extract agar. Conjugated cells gave rise to hyphae that produced chlamydospores. Nuclear staining showed that the hyphal cells were generally uninucleate although about 5% were binucleate. Occasionally, strains of one mating type formed limited amounts of hyphae with chlamydospores, but the other mating type did not. Less than 1% of the chlamydospores germinated and formed buds, hyphae, or infrequently structures resembling a promycelium. The isolates did not mate with cultures of *C. laurentii* from other sources.

3299 • Copper-Hydrogenated Soybean and Linseed Oils: Composition, Organoleptic Quality and Oxidative Stability
J. C. Cowan, S. Koritala, K. Warner, G. R. List,
K. J. Moulton, and C. D. Evans
J. Amer. Oil Chem. Soc. 50(5): 132-136. May 1973

Copper and nickel hydrogenations give a wide distribution of double bonds in the monoene fraction from both reduced soybean and linseed oils. With copper catalysts, high-pressure hydrogenation reduces the extent of this

double bond distribution when compared with low pressure hydrogenation. With nickel catalysts, some Δ17-octadecenoate is formed but less than with a copper catalyst.

In room odor evaluations, copper-hydrogenated soybean (CuHSB) oil gave higher scores and lower fishy responses than nickel-hydrogenated soybean oil after both had been exposed to fluorescent light. A mixture of CuHSB oil (33%) and peanut oil received room odor scores equal to or better than peanut oil alone, whether light exposed or not. Although hydrogenated products with remarkable stability to oxidation were obtained by copper hydrogenation of linseed oil, these oils have lower organoleptic stability when compared to nickel-hydrogenated, winterized soybean oil.

- 3300 • Heat Inactivation of Trypsin Inhibitor, Lipoxygenase and Urease in Soybeans: Effect of Acid and Base Additives
E. C. Baker and G. C. Mustakas
J. Amer. Oil Chem. Soc. 50(5): 137-141. May 1973

Effects of chemical additives on the heat inactivation of trypsin inhibitor (TI), lipoxygenase, and urease in soybeans were investigated. The nutritional value of soybeans increases when antigrowth factors, such as TI, are inactivated. Inactivation of lipoxygenase enhances palatability and storage stability. Heat inactivation of antinutritional factors during immersion cooking of dry soymeats was studied without additives. Processing time was varied from 15 minutes to 2 hours over a temperature range of 120-212°F. The experiments were repeated, with the addition of NaOH or HCl to the cooking water. Without additives, lipoxygenase proved to be the most heat labile and TI, the least. With either acid or base additives, the initial inactivation of urease and lipoxygenase was accelerated significantly; however, while TI inactivation was accelerated by base, it was retarded by acid addition.

- 3301 • Surfactants from Fatty Esters of Polyalkoxylated Polyol Glycosides
C. A. Wilham, T. A. McGuire, C. L. Mehlretter, and F. H. Otey
J. Amer. Oil Chem. Soc. 50(5): 155-158. May 1973

The glycoside raw materials used to prepare surfactants were mixtures produced directly from low-cost starch and polyols by transglycosidation. After alkoxylation with ethylene oxide and propylene oxide, the glycosides were transesterified by the methyl esters of various fatty acids to yield the final products. Monolaurates of the polyalkoxylated glycosides containing a combination of 8 moles of ethylene oxide and 4 moles of propylene oxide per mole of glycoside showed detergency in an alkaline formulation comparable to two commercial detergents. An advantage in this application

is the potential for complete biodegradation because of the fatty ester carbohydrate structures. The two monolaurates of glycerol glycoside polyethers containing 4.8 and 8 moles of propylene oxide, in particular, produced oil-in-water emulsions of high stability.

3302 • Fatty Esters of Polyalkoxylated Polyol Glycosides as Bread Additives

M. M. Bean,¹ C. L. Mehltretter, C. A. Wilham, and T. A. McGuire
(¹West. Reg. Res. Lab., Albany, Calif.)

Food Prod. Develop. 7(3): 30, 32. April 1973

A series of fatty esters of polyalkoxylated glycerol and propylene glycol glycosides have been prepared and evaluated as dough conditioners to improve loaf volume and grain of bread baked with soy-fortified wheat flour.

3303 • Cationic Aminoethyl Cereal Flours. Semicommercial Production

J. C. Rankin, E. B. Lancaster, B. S. Phillips, and J. C. McClendon¹

(¹Dow Chemical Co., Freeport, Texas)
Staerke 25(3): 95-97. March 1973

Both soft white wheat and yellow corn flours were reacted with ethylenimine by a continuous, dry process capable of making up to 300 pounds of cationic aminoethyl cereal flour per hour. When either cationic flour was evaluated as a wet-end paper additive, each was equivalent to a high-quality commercial cationic corn starch in improving dry-strength properties of paper and increasing pigment retention. Laboratory storage of the flour products for one-half year did not change their effectiveness. Estimates based on a plant producing 15 million pounds of cationic flour a year indicate that the cost-to-make is about 10 cents per pound.

3304 • Powdered Elastomers. Starch Xanthide-Encased SBR 1502

[T. P. Abbott and R. A. Buchanan]

North. Reg. Res. Lab.

U.S. Agr. Res. Serv., CA-NRRL-40, 4 pp. May 1973 [Processed]

New powdered elastomers developed at the Northern Regional Research Laboratory consist of latex particles encased in either starch or flour derivatives that serve as rubber-reinforcing agents. Selected powdered elastomers have been prepared on a pilot-plant scale.

- 3305* • Mycotoxin Research: Selected Areas Pertinent to Feedstuffs
Alex Ciegler
Amer. Feed Manufacturers Ass. Nutr. Counc. Proc., New Orleans,
La., pp. 37-40. November 16-17, 1972

Current research efforts on mycotoxins are reviewed, particularly as they affect the feedstuffs. Areas of research emphasized are rapid analytical methods for aflatoxin in feedstuffs, surveys, aflatoxin prevention and detoxification, mycotoxin binding and complex formation, and residues in meat.

- 3306 • Interpretation of the Solubilities of Mixtures of
 β -Lactoglobulins A and B
J. S. Wall and A. C. Beckwith
Biopolymers 12(4): 931-936. April 1973

Earlier investigators demonstrated that interactions between the genetic variant β -lactoglobulins A and B resulted in anomalous solubility curves for solutions of mixtures of the two proteins. Equations are derived that relate solubilities of the mixtures in equilibrium with solid to those of pure variant β -lactoglobulin species at various ionic strengths. These equations indicate that the solubilities of the mixed proteins are subject to established principles of mass action and electrostatic interactions.

- 3307 • Concanavalin A as a Probe of Phosphomannan Molecular Structure
M. E. Slodki, R. M. Ward, and J. A. Boundy
Biochim. Biophys. Acta 304(2): 449-456. April 1973

The diploid yeast *Hansenula holstii* NRRL Y-2448 produces a highly viscous extracellular phosphomannan that does not interact with concanavalin A. Autohydrolysis of the polymer cleaves mannosyl α -1-phospho-6'-mannosyl links to yield mannose-6 phosphate-based oligosaccharides (90%) and a highly phosphorylated core polysaccharide (10%). The core polymer strongly interacts with concanavalin A. Intact phosphomannans produced by mucoid (NRRL Y-2154) and relatively nonmucoid (NRRL Y-2155) parent haploid strains are less viscous and interact with concanavalin A. Autohydrolysis of these polymers also gives rise to oligosaccharide and core phosphomonooesters. These mannan phosphate cores also strongly interact with concanavalin A. The intensities of phosphomannan interactions with concanavalin A likely reflect the extent to which reactive sites in the polymer cores are covered by nonreactive oligosaccharide polyphosphodiester branches.

- 3308 • Intrinsic Viscosity Calculated by Computer
B. T. Hofreiter, J. O. Ernst, and W. L. Williams
J. Appl. Polym. Sci. 17(5): 1449-1454. May 1973

A computer program has been devised for routine use that processes such raw data as polymer sample weight, moisture content, solution volume, and viscometer flow times to calculate a least-squares-derived intrinsic viscosity. In addition to eliminating errors inherent in graphic solutions and freeing technicians from tedious calculation, the computer output provides the 95% confidence interval of intrinsic viscosity.

- 3309 • Thiolation of Starch and Other Polysaccharides
D. Trimmell, B. S. Shasha, W. M. Doane, and C. R. Russell
J. Appl. Polym. Sci. 17(5): 1607-1615. May 1973

Thiolated starches with a degree of substitution 0.01-0.6 have been obtained by pyrolysis of starch dithiobis(thioformates) followed by saponification. The pyrolytic decomposition of dithiobis(thioformates) followed two pathways: (1) to thionocarbonate (ROCOR), carbon disulfide, and sulfur and (2) to dithiocarbonate (ROCSR), carbonyl sulfide, and sulfur. Only the second pathway affords thiolation. Thiol groups were determined by Ellman's reagent, by sulfur analyses, and following acetylation by the ratio of *O*-acetyl versus *S*-acetyl absorption in nuclear magnetic resonance spectra. The polysaccharides cellulose, dextran, and xylan were thiolated by the same procedure.

- 3310 • Viscosity Profiles for Aqueous Dispersions of Extracellular Anionic Microbial Polysaccharides
Allene Jeanes and J. E. Pittsley
J. Appl. Polym. Sci. 17(5): 1621-1624. May 1973

Viscosity (resistance to flow) is probably the most important property contributed by a polysaccharide to aqueous systems, and the corresponding rheological (flow and deformation) properties are basic to any function served by these systems. Characterization of polysaccharides through their viscous and rheological properties, however, often has been neglected in generalized polysaccharide research. Neither techniques applicable for nonspecialists have been available nor instruments of suitable design and construction that met the need for simple operation and small sample size.

Of unusual significance for practical research on polysaccharides, therefore, is the technique developed by Patton [J. Paint Technol. 38, 656 (1966)] for obtaining viscosity profiles of non-Newtonian polysaccharide solutions and rheological characterization extending into the ultra-low shear-rate range by use of a commercial micro cone and plate viscometer.

Reported here is our application of Patton's spring-relaxation technique for a cone and plate viscometer to a series of extracellular anionic microbial polysaccharides developed in our research on hydrocolloids of possible practical utility.

3311 • Extracellular Mannans and Phosphomannans: Structural and Biosynthetic Relationships

M. E. Slodki, R. M. Ward, J. A. Boundy, and M. C. Cadmus
Proc. IV Int. Ferment. Symp. "Fermentation Technology Today,"
ed. G. Terui, held at Kyoto, Japan, March 19-25, 1972,
pp. 597-601. 1972

For some time the Northern Laboratory has been engaged in the study of extracellular phosphomannans elaborated by yeasts of the genus *Hansenula* and related genera. It became apparent early that we were dealing with a family of novel polymers, each unique to a particular species of yeast. Recently we found that these yeasts alternatively synthesize neutral α -mannans when orthophosphate is omitted from the culture medium. Examination of the mannan structures has now progressed sufficiently to reveal that, as with the phosphomannans, species-characteristic mannan polymers are formed. This review covers our current knowledge of structures, compares relationships between neutral and phosphorylated mannans, and considers some biosynthetic implications of these findings.

3312 • Polyesteramides from Linseed and Soybean Oils for Protective Coatings: Alkyd-Type Polymers

W. J. Schneider, L. E. Gast, V. E. Sohns, and J. C. Cowan
J. Paint Technol. 44(575): 58-63. December 1972

By a simplified synthesis, "alkyd" polyesteramides and urethane derivatives have been prepared and their film properties evaluated in the laboratory. This synthesis involves aminolysis of linseed or soybean oil with diethanolamine to produce a mixture of *N,N*-bis(2-hydroxyethyl)fatty amide, glycerol, mono- and diglyceride, and unreacted diethanolamine. Direct esterification of this mixture with dibasic acids or anhydrides forms hydroxyl-terminated prepolymers of several desired hydroxyl levels. Subsequent reaction with tolylene diisocyanate forms urethane-polyesteramides.

Air-dried films of these urethane-polyesteramides exhibit improved properties over the more linear products prepared previously. They dry faster to harder films; resist 5% hydrochloric acid for slightly longer times; and show excellent xylene resistance, much improved alkali resistance, and good adhesion to metal. Film properties of these experimental urethane-polyesteramides compared well with those of four commercial alkyd resins, a linseed-urethane oil, a urethane-resin, and a soy-urethane spar varnish.

A preliminary cost estimate has been made based on an annual plant capacity of 5 million pounds of polyesteramides. Costs vary from 15.6 to 23.2 cents per pound for products, depending on composition.

- 3313 • *Dimorphotheca sinuata* Lipoxygenase: Formation of 13-L-Hydroperoxy-*cis*-9,*trans*-11-Octadecadienoic Acid from Linoleic Acid
H. W. Gardner, D. D. Christianson, and R. Kleiman
Lipids 8(5): 271-276. May 1973

Lipoxygenase (EC 1.13.1.13) from *Dimorphotheca sinuata* seed oxidized linoleic acid to predominantly 13-L-hydroperoxy-*cis*-9,*trans*-11-octadecadienoic acid. When the reaction proceeded at pH 6.9, the 13-hydroperoxide was the only isomer detected; but at pH 5.1, the 13-isomer was 92% of the total, the remaining 8% being the 9-hydroperoxide. At both pH's small amounts of hydroxyoctadecadienoic acid accumulated during the reaction. This acid from the pH 6.9 reaction was analyzed as 13-hydroxy-*cis*,*trans*-octadecadienoic. The postulate advanced by many workers that dimorphecolic acid, 9-D-hydroxy-*trans*-10,*trans*-12-octadecadienoic acid, is biosynthesized via a lipoxygenase product was not proved.

Although the product specificity of *D. sinuata* lipoxygenase is like that of lipoxygenase type 1 from soybeans, its inactivity at pH 9 demonstrated that it is a novel enzyme.

- 3314 • Sperm Whale Oil Analysis by Gas Chromatography and Mass Spectrometry
G. F. Spencer and W. H. Tallent
J. Amer. Oil Chem. Soc. 50(6): 202-206. June 1973

Gas liquid chromatography of winterized sperm oil showed that its wax esters with even carbon numbers range from C₂₄ to C₄₂ and are present in quantities resembling a normal distribution curve with C₃₄ as the mean. Between these even-numbered wax esters, ones with odd chain lengths were

eluted. Triglycerides, similarly present in a normal distribution pattern, ranged from C₄₂ to C₅₈ and also included traces of odd chain species. The component acids and alcohols were analyzed by gas chromatography-mass spectrometry, and double bond positions in the monoenooid components were established. Branched chain and odd chain constituents, both saturated and unsaturated, were detected among both alcohols and acids. These moieties, when combined with those having even chains, are responsible for the wax esters and triglycerides with odd carbon numbers.

3315 • Determination of Rhodium on Commercial Carbon- and Alumina-Supported Catalysts

G. R. List, J. P. Friedrich, W. F. Kwolek,¹ and C. D. Evans
(¹Biometrical Services, North Central Region, Peoria, Ill.)

J. Amer. Oil Chem. Soc. 50(6): 210-212. June 1973

Methods are described to determine metallic rhodium on small samples of either carbon or alumina catalyst supports. After the catalysts were digested with hot mineral acids, the solutions were analyzed by an established colorimetric method, and results were compared with those from an atomic absorption procedure. Statistical analysis showed that the two methods were equal in precision with a combined standard deviation of 0.08 for a 5.0% rhodium catalyst.

3316 • Long Term Storage of Soybean and Cottonseed Salad Oils

C. D. Evans, G. R. List, Helen A. Moser, and J. C. Cowan
J. Amer. Oil Chem. Soc. 50(6): 218-222. June 1973

Commercially prepared and packaged soybean and cottonseed salad oils from several different processors were evaluated periodically during storage for 12 months. Partially hydrogenated and winterized soybean oils, as well as unhydrogenated soybean salad oils, were stored in bottles and cans at 78 and 100° F. Control samples of all oils were held at 0° F. during the entire test. Some lots in bottles and cans were packaged under nitrogen to improve storage stability. Agreement was good between organoleptic and oxidative evaluation of aged oils. After 26 weeks of storage at 100° F., the flavor of partially hydrogenated-winterized oils packaged under nitrogen showed a minimum loss. These same oils did not exhibit much, if any, reduction in their oxidative stability as indicated by storage peroxide values (active oxygen method). Soybean oil not protected with nitrogen demonstrated progressive flavor deterioration at 100° F. After 10 weeks of storage, the deterioration became marked and the flavor score was below 5. From limited observations, bottled oils appear to have a

better stability than oils packaged in screw-cap tin cans. Hydrogenated oils packaged under nitrogen in cans had good oxidative stability, but some lowering of the flavor score was observed. Nonhydrogenated soybean oils packaged in tin cans not under nitrogen exhibited the most rapid flavor deterioration of all lots of oil investigated.

3317 • Starch Xanthide Filled Elastomers

E. B. Bagley and R. J. Dennenberg
Rubber Age 105(6): 41-47. June 1973

Powdered rubbers are readily prepared by coprecipitation of starch xanthides and rubbers from starch xanthide-rubber latex mixtures. When powdered rubbers prepared with xanthates having a degree of substitution (D.S.) greater than 0.1 are processed, sulfur in the xanthide linkages contributes significantly to crosslinking the rubber. If the contributions of xanthide sulfur to the crosslinking reaction are not taken into account, overcure of the system results. At suitable starch xanthide concentrations vulcanization can proceed to the desired levels without addition of any of the usual compounding ingredients, such as sulfur, zinc oxide, stearic acid, or accelerators. Simultaneously, the starch xanthide in the final vulcanizate serves as an effective reinforcing agent. Thus powdered rubbers prepared with starch xanthides of suitable D.S. can be processed directly to a crosslinked reinforced elastomer without adding any other ingredients. Curing kinetics were followed on an oscillating disc rheometer. Various physical properties were measured both on the dry vulcanizate and after 70-hour water-immersion tests.

3318 • Mycotoxin Production Affected by Insecticide Treatment of Wheat

E. E. Vandegraft, O. L. Shotwell, M. L. Smith, and
C. W. Hesselton
Cereal Chem. 50(3): 264-270. May-June 1973

Insecticide treatment of wheat both increased and decreased aflatoxin and ochratoxin production depending on the fungal strains used--*Aspergillus flavus*, *A. parasiticus*, *A. ochraceus*, and *Penicillium viridicatum*. Some strains were affected the same by phosphine and carbon tetrachloride: carbon disulfide treatment while others were affected oppositely. In some experiments the effect of insecticide treatment was significant on wheat sterilized by autoclaving at about 25% moisture but not on unsterilized. Mycotoxin production by most molds is enhanced on wheat sterilized by autoclaving before inoculation.

- 3319 • Cooked Corn Germ: Composition of Fractions Separated According to Particle Size by Sieving and Air Classification
H. W. Gardner, W. J. Garcia, A. C. Stringfellow, and
G. E. Inglett
Cereal Chem. 50(3): 303-308. May-June 1973

Corn germ tempered at 30% moisture was cooked on gas-fired flaking rolls set at 350° F. (177° C.). The cooked germ flakes were defatted and separated into fractions by a combination of sieving, pin milling, and air classification. Compositional data collected for the sized fractions indicated that generally a separation of endosperm and germ tissue occurred. The largest particles were most characteristic of endosperm and the smallest, germ tissue. Endosperm material found in cooked germ flakes was due to endosperm fragments common to the dry-milled germ fraction. Starch content in the largest particle fraction was 46%, while the two finest fractions contained only 9%. Some of the finest fractions had 27% protein composed of more than 5% lysine and only 3 to 4% fiber. There was also a striking separation of ash content among the fractions; the finest particle contained 14% ash and the largest, 5%.

- 3320 • Bacteria, Spirochetes, and Rickettsia as Insecticides
Grant St. Julian, Lee A. Bulla, Jr., Eugene S. Sharpe,
and Gordon L. Adams
In "Regulation of Insect Populations by Microorganisms,"
ed. Lee A. Bulla, Jr., Ann. N.Y. Acad. Sci. 217: 65-75.
June 1973

Classic descriptions of bacteria attacking the epidermis, perivisceral cavity, blood, adipose tissue, and cardiac tissue reveal that these microorganisms are most useful in regulating insect pest populations. Nonsporulating bacterial pathogens are exemplified by the infection of grasshoppers with *Pseudomonas aeruginosa*. *Serratia marcescens* both naturally and experimentally infect the waxmoth, the European corn borer, and the gypsy moth. Among the best known sporulating bacteria pathogens of insects are: *Bacillus cereus* found associated with the southern armyworm, the American cockroach, and the spruce budworm; *Bacillus thuringiensis*, which kills more than 100 species of butterflies and moths; *Bacillus popilliae* and *B. lentimorbus*, the causative agents of "milky disease" in a dozen different beetles. The last three bacteria are used commercially as effective insecticides. The spirochete *Spirochaeta pieridis* causes a septicemia in cabbage butterfly caterpillars. The insect pathogen *Rickettsia melolontha* induces "Lorsch disease" in several species of beetle larvae. The pathogenic relationship is elaborated of 75 other species of microorganisms to more than 100 species of insects.

- 3321 • Extracellular Microbial Polysaccharides: New Hydrocolloids Having Both Fundamental and Practical Import
Allene Jeanes
In "Water-Soluble Polymers," ed. N. M. Bikales, Polym. Sci. Technol. Ser., vol. 2, pp. 227-242. New York. 1973

Now established among the hydrocolloids of commerce are several macro-molecular polysaccharides produced by nonpathogenic microorganisms cultured on glucose or sucrose as carbon source's. The distinctive properties of these biopolymers, based on composition and structure different from other hydrocolloids, determine their uses in food, pharmaceutical, petroleum, and various other industries. Selection and development of other types may be expected from among the myriads of natural sources. Fundamental research, upon which vigorous practical developments depend, will be advanced by elucidating basic information on these uniquely constituted biocolloids.

- 3322 • Graft Copolymers of Starch and Poly(2-hydroxy-3-methacryloyloxypropyltrimethylammonium Chloride). Dependence of Graft Copolymer Structure on Method of Initiation
George F. Fanta, Robert C. Burr, W. M. Doane, and C. R. Russell
In "Water-Soluble Polymers," ed. N. M. Bikales, Polym. Sci. Technol. Ser., vol. 2, pp. 275-290. New York. 1973

Graft copolymers of wheat starch and 2-hydroxy-3-methacryloyloxypropyltrimethylammonium chloride (I) were prepared by different methods of free radical initiation and were compared with respect to percent poly(I) incorporated in the copolymer, molecular weight of grafted poly(I), and grafting frequency. Chemical initiation (ceric ion or ferrous ion-hydrogen peroxide) led to the lowest molecular weight for grafted poly(I) and the most frequent grafting, whereas initiation by preirradiation of starch with cobalt 60 gave fewer and higher molecular weight poly(I) grafts. Polymerization by heat and mastication was initiated by either extruding a mixture of starch, I, and water through a die at 100° C. or by adding a similar mixture to hot xylene. These conditions produced poly(I), which was apparently crosslinked. The influence of selected reaction conditions on the cobalt 60-initiated graft polymerization was studied. Graft copolymers prepared by the different initiation methods were tested as flocculants for diatomaceous silica.

3323 • The Use of Neutralized Soybean Oil Soapstock for Broilers

H. Mengel¹ and R. E. Beal

(¹Animal Science Research Division, ARS, USDA, Beltsville, Md.)

Poultry Sci. 52(1): 219-222. January 1973

Comparative broiler feeding trials were conducted with a neutralized, dried soybean soapstock (NDSS) and a commercial feed fat (CFF). In the first trial, 4 replicates of 20 chicks each were fed the CFF. Another series of 4 replicates of 20 chicks each were given the same type of diet in which NDSS was substituted for the CFF. This format was repeated in the second trial. The results of both trials show no significant differences in body weights or feed consumption between the groups fed either the NDSS or the CFF. No differences in rate of mortality were observed with either treatment. NDSS produced a shank pigmentation score significantly greater than that obtained with feeding CFF. These results demonstrate that NDSS can be used successfully in broiler feeds as a source of energy and as a pigmenter. The production of NDSS does not present a problem of waste disposal as does the CFF.

3324 • Seed Composition of *Hildegardia barteri*

G. E. Inglett, J. F. Cavins, and G. F. Spencer

Econ. Bot. 27(1): 128-130. January-March 1973

The seeds of *Hildegardia barteri* (Mast.) Kosterm. (Sterculiaceae) are consumed in West Africa as raw or roasted nuts and have a flavor resembling peanuts. The *H. barteri* tree grows from the Ivory Coast to Nigeria and is called the Krobo Christmas tree. It has distinct ornamental value since its flowers are conspicuous on leafless branches in the dry season. Seed composition data, including fatty acid and amino acid analyses, are reported.

3325 • Polyacrylonitrile Distribution in Grafted Starch Granules

Determined by Scanning Electron Microscopy

George F. Fanta, F. L. Baker, Robert C. Burr, W. M. Doane,

and C. R. Russell

Staerke 25(5): 157-161. May 1973

The location of polyacrylonitrile (PAN) within the starch granule matrix was determined for two wheat starch-PAN graft copolymers, which contained 22% and 44% grafted PAN. Granules of graft copolymer (which closely resembled ungrafted starch in appearance) were fractured by ballmilling. The milled copolymer was then heated under reflux in dilute hydrochloric

acid to remove the starch moiety, and fracture surfaces in the remaining PAN (which was inert to these conditions) were examined with a scanning electron microscope. Areas in the grafted granules that contained little or no PAN appeared as voids in the fracture surfaces. Micrographs suggested that granules of low add-on graft copolymer were largely surface-grafted. In the higher add-on product, grafting had taken place throughout most of the granule interior; however, small areas in the centers of some granules still contained little or no PAN.

- 3326 • Composition of Three Food Products Containing Defatted Corn Germ Flour
C. W. Blessin, W. J. Garcia, W. L. Deatherage, J. F. Cavins,
and G. E. Inglett
J. Food Sci. 38(4): 602-606. May-June 1973

A defatted corn germ flour, prepared from a commercial dry-milled fraction, was incorporated in three food products. Adding the flour to cookies reduced starch content and increased protein and ash levels. Amino acid and mineral compositions were improved, especially at the higher percentages of flour. Lysine and tryptophan content of the protein doubled while phosphorus, potassium, magnesium, and iron increased significantly. In corn muffins similar effects occurred but were of less magnitude. Combining the flour with ground beef increased yield of the broiled meat product. Protein, fat, ash, and fiber values were acceptable in beef patties at the 3 to 5% addition levels. Amino acid composition of the protein remained essentially constant, but mineral composition changed considerably as shown by increases in phosphorus, potassium, magnesium, and iron. The work demonstrates that defatted corn germ flour could possibly serve as a supplement in many foods.

- 3327 • Iron-Fortified Syrup Blends: Preparation, Characteristics,
Application
G. N. Bookwalter, L. T. Black, and K. A. Warner
J. Food Sci. 38(4): 618-622. May-June 1973

Stable iron-containing syrups were developed to provide a liquid iron source that can be conveniently added to foods. Preparation of iron-fortified syrup blends consisted of combining corn syrup, or sucrose, or both, with water, heating to boiling, and cooling to 190°-200° F. An aqueous iron solution was then added, blended, and poured into pint bottles.

Syrups were an all-sucrose (67% solids), blends of 15% sucrose with either regular or high-conversion corn syrups (75% solids), and an all-high-conversion corn syrup (75% solids). Iron sources were ferric ammonium citrate, ferric choline citrate, ferrous gluconate, and ferrous sulfate

at levels of 0.1 to 1.0 gram per pint. Stability characteristics and food applications were investigated.

These iron-fortified syrups were stable after storage for 6 months at 100° and after 1 year at 77° F., except combinations of ferrous forms with blends containing either 15% sucrose and regular corn syrup or all-sucrose. All blends containing 15% sucrose and high-conversion corn syrup with added iron were stable. Although flavor evaluations indicated that iron was readily detectable, no significant differences between the iron forms, before or after storage, were noted. Iron-fortified syrups appear to be suitable for infant formulas, bread, and breakfast beverages.

3328* • **Plectomycetes; Eurotiales**

Dorothy I. Fennell

In "The Fungi," eds. G. C. Ainsworth, A. S. Sussman, and F. Sparrow, vol. 4A, chap. 4, pp. 45-68. New York. 1973

In the fourth and final volume of *The Fungi*, covering systematics, this chapter includes a general discussion of the Plectomycetes and a more detailed consideration of the Eurotiales. Fifty-eight genera (with synonyms) are arranged in nine families. Dichotomous keys based on morphological characters are provided and are designed to permit identification of families and genera. Illustrative material and an extensive bibliography are also included.

3329* • **Microscopic Observations of Germination and Septum**

Formation in Pycnidiospores of *Botryodiplodia theobromae*

William P. Wergin,¹ Larry D. Dunkle,² James L. Van Etten,²

Grant St. Julian, and Lee A. Bulla, Jr.

(¹Southern Weed Science Laboratory, U.S. Delta States Agricultural Research Center, ARS, Stoneville, Miss.;

²University of Nebraska, Lincoln)

Develop. Biol. 32(1): 1-14. May 1973

A population of aseptate pycnidiospores of the fungus *Botryodiplodia theobromae* can be induced to germinate or to form septa delimiting two cells; this developmental process is dependent upon nutritional and environmental factors. Transmission electron microscope investigations indicate that during germination of the aseptate spore, a new inner wall layer is synthesized *de novo* at the site of germ tube emergence. Formation of the septum also involves the *de novo* synthesis of an inner wall layer which

comprises the majority of the septum and completely surrounds the spore. The wall of the germ tube emerging from the septate spore is a direct extension of this inner layer deposited during the formation of the septum. Although the early stages of spore germination may involve localized enzymatic degradation of the internal layers of the spore wall, transmission and scanning electron micrographs of germinating spores show that the outer wall layers are physically fractured by the emerging germ tube. It is suggested that spore germination and septum formation are initially similar processes regarding cell wall genesis but that some mechanism responsive to environmental and nutritional conditions determines the course of development.

CONTRACT AND GRANT RESEARCH PUBLICATIONS

[Report of research work done by an outside agency under contract with the U.S. Department of Agriculture and supervised by the Northern Regional Research Laboratory.]

- 255-C* • Utilization of α -Methyl-D-mannoside by *Bacillus popilliae*
Amaret Bhumiratana and R. N. Costilow
Michigan State University, East Lansing
Can. J. Microbiol. 19(2): 169-176. February 1973

- 256-C* • Starch Graft Polymers. III. Preparation of Graft Polymers Containing Acrylamide, Acrylic Acid and β -Methacryloyloxyethyltrimethylammonium Monomethyl Sulfate and Evaluation as Flocculants for Bauxite Ore Red Mud Suspensions
D. A. Jones and L. F. Elmquist
General Mills Chemicals, Minneapolis, Minn.
Staerke 25(3): 83-89. March 1973

- 257-C* • Rapid Micro Kjeldahl Digestion of Cereal Grains and Other Biological Materials
Jose Madrid Concon and Diane Soltesz
University of Kentucky, Lexington
Anal. Biochem. 53(1): 35-41. May 1973

[Report of research done by an outside agency under a grant from the U.S. Department of Agriculture and supervised by the Northern Regional Research Laboratory.]

- 129-G* • Differential Heat Stabilities of *Bacillus Amylases*
Barry O. Bliesmer and Paul A. Hartman
Iowa State University, Ames
J. Bacteriol. 113(1): 526-528. January 1973

- 130-G* • Light Scattering Analysis of Starch Granules
J. Borch, A. Sarko, and R. H. Marchessault
State University of New York, College of Forestry, Syracuse
J. Colloid Interface Sci. 41(3): 574-587. December 1972
- 131-G* • Structure and Function of Amylases. II. Multiple Forms
of *Bacillus subtilis* α -Amylase
John F. Robyt and Rosalie J. Ackerman
Iowa State University, Ames
Arch. Biochem. Biophys. 155(2): 445-451. April 1973
- 132-G* • Preparation of Unsubstituted 6-Aldehydo celluloses by
Photolysis of 6-Azido-6-deoxy celluloses
Derek Horton,¹ Arthur E. Luetzow,¹ and Olof Theander²
¹The Ohio State University, Columbus; ²Swedish Forest
Products Research Laboratory, Stockholm
Carbohydr. Res. 26(1): 1-19. January 1973
- 133-G* • Preparation of 6-Chloro-6-deoxyamylloses of Various Degrees
of Substitution; an Alternative Route to 6-Aldehydoamyllose
Derek Horton,¹ Arthur E. Luetzow,¹ and Olof Theander²
¹The Ohio State University, Columbus; ²Swedish Forest
Products Research Laboratory, Stockholm
Carbohydr. Res. 27(1): 268-272. March 1973
- 134-G* • Theoretical Analysis of Failure in a Viscoelastic Slab
Subjected to Temperature and Moisture Gradients
J. R. Hammerle
North Carolina State University, Raleigh
Trans. ASAE 15(5): 960-965. September-October 1972

[Report of research work supported with funds provided by the U.S. Department of Agriculture under the authority of U.S. Public Law 480, 83rd Congress, and sponsored by the Northern Regional Research Laboratory.]

- 353-F • Lectins: Cell-Agglutinating and Sugar-Specific Proteins
 Nathan Sharon and Halina Lis
 The Weizmann Institute of Science, Rehovot, Israel
 Science 177(4053): 949-959. September 1972
- 354-F • A New Isoflavone from Soya Beans
 M. Naim,¹ B. Gestetner,¹ I. Kirson,² Y. Birk,¹ and A. Bondi¹
¹The Hebrew University of Jerusalem, Rehovot, Israel; ²The Weizmann Institute of Science, Rehovot, Israel
 Phytochemistry 12(1): 169-170. January 1973
- 355-F • Association of Carbohydrates with Amines. Part 1. Proton Donor-Acceptor Complexes of D-Glucose, D-Mannose, D-Galactose, 2-Amino-2-deoxy-D-glucose, and Maltose with Ethylenediamine
 S. P. Moulik and A. K. Mitra
 Jadavpur University, Calcutta, India
 Carbohyd. Res. 23(1): 65-74. June 1972
- 356-F • Fundamental Studies on the Interaction of Alkaline-Earth Metals with Carbohydrates. I. Reaction of D-Glucose and Maltose with the Hydroxides of Barium, Calcium, and Strontium
 Nirmolendu Roy and A. K. Mitra
 Jadavpur University, Calcutta, India
 Carbohyd. Res. 24(1): 175-179. September 1972
- 357-F • Fundamental Studies on the Interaction of Alkaline-Earth Metals with Carbohydrates. II. Behavior of Some Disaccharides Towards the Hydroxides of Barium, Calcium, and Strontium
 Nirmolendu Roy and A. K. Mitra
 Jadavpur University, Calcutta, India
 Carbohyd. Res. 24(1): 180-183. September 1972
- 358-F • Formation of Proton-Transfer Complexes of 2-Amino-2-deoxy-D-glucose and Other Simple Organic Bases with Violuric Acid
 S. P. Moulik, C. R. Sahu, and A. K. Mitra
 Jadavpur University, Calcutta, India
 Carbohyd. Res. 25(1): 197-203. November 1972

January-June 1973

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PATENTS

[These patents are assigned to the Secretary of Agriculture. Copies of patents may be purchased (50 cents each) from the Commissioner of Patents, U.S. Patent Office, Washington, D.C. 20231. Order by number, do not send stamps.]

Production of Mannans by Fermentation

Morey E. Slodki, Millie Jo Smiley, and Dwight E. Hensley
U.S. Patent 3,713,979. January 30, 1973

Mannan polymers are produced extracellularly by yeast previously known to produce only phosphomannans. Hydrolysis of the polymers with a mineral acid catalyst results in substantially pure D-mannose.

Powdered Resorcinol-Formaldehyde Treated Polysaccharide-Reinforced Elastomer Masterbatches, Compounds, and Resulting Vulcanized Rubbers

Russell A. Buchanan and Charles R. Russell
U.S. Patent 3,714,087. January 30, 1973

Powdered elastomer masterbatches are prepared by grinding dried rubber curds which contain highly effective reinforcing agents. Such finely comminuted elastomer masterbatches provide stable powdered rubber compounds when blended with usual powdered curatives and fine particle fillers. These powdered rubber compounds are formed into finished vulcanized rubber articles by direct heat-compression molding, by extrusion from a simple machine, or by injection molding without prior high shear mixing.

Hydroxy-Conjugated Fatty Acids

Edward A. Emken
U.S. Patent 3,729,379. April 24, 1973

Method is disclosed for producing hydroxy-conjugated fatty acids from linoleic acid soaps dispersed in an aqueous medium containing dimethyl sulfoxide with the enzyme soybean lipoxygenase.

Starch Xanthate Derivatives Used in Papermaking

George G. Maher

U.S. Patent 3,730,829. May 1, 1973

A method of preparing paper is disclosed which includes the step of adding to the paper pulp the products of the reaction of starch xanthate with either an alkyl diglycidal ether or an alkyl diepoxide to thus increase burst, wet and dry strength, and fold endurance of the paper. This reaction may take place ex or in situ to the pulp.

Biodegradable Surfactants from Starch-Derived Glycosides

Peter E. Throckmorton, David Aelony, Richard R. Egan, and Felix H. Otey

U.S. Patent 3,737,426. June 5, 1973

Highly biodegradable surface-active products for cleaning and emulsifying agents and the like are obtained by the chemical reaction of starch-derived ethylene and propylene polyol glycosides such as glycol and glycerol glycosides with ethylene and propylene oxides, long-chain epoxyalkanes, and chlorosulfonic acid.

LICENSING OF PATENTS

Many inventions and discoveries of the Northern Laboratory are covered by patents assigned to the Secretary of Agriculture.

Assigned patents are available for use by business and industry under either exclusive or non-exclusive licenses. Conditions

applicable to the granting of licenses are set forth in the Federal Register, May 14, 1970 [35(94): 7493-7495]. Further information can be obtained from the Administrator, Agricultural Research Service, U.S. Department of Agriculture, Washington, D.C. 20250.

The Northern Regional Research Laboratory is part of the Agricultural Research Service of the U.S. Department of Agriculture. Congress in 1938 authorized four regional laboratories to conduct broad and complex investigations in the field of chemistry and related physical sciences to expand and improve the marketability of agricultural commodities. A fifth laboratory was completed in 1969 at Athens, Georgia. The addresses and commodities covered are:

<u>Laboratory</u>	<u>Principal Fields of Research</u>
Eastern Regional Research Laboratory 600 East Mermaid Lane Philadelphia, Pennsylvania 19118	Animal fats; dairy products; deciduous fruits; hides and leather; maple sap and sirup; meat and meat byproducts; potatoes and other vegetables.
Northern Regional Research Laboratory 1815 North University Street Peoria, Illinois 61604	Cereal grains: corn, wheat, grain sorghum, barley, and oats; oilseeds: soybean, flaxseed, and erucic acid-containing oilseeds; and new crops.
Richard B. Russell Agricultural Research Center P. O. Box 5677 Athens, Georgia 30604	Southeastern poultry, fruits, and vegetables; pecans and peanuts; forages and feeds; sunflower as an oilseed; pork; and tobacco.
Southern Regional Research Laboratory P. O. Box 19687 New Orleans, Louisiana 70179	Cotton and cottonseed; peanuts; rice; sweet potatoes; and sugarcane.
Western Regional Research Laboratory Berkeley, California 94710	Western fruits, nuts, vegetables, oilseeds, and rice; poultry products; forage crops; wheat and barley; wool and mohair; dry beans and peas; castor; and safflower.

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